US005762385A

United States Patent [19]

Mader et al.

[11] Patent Number: 5,762,385

[45] Date of Patent: Jun. 9, 1998

[54] **PUSH PAD TRIGGER RELEASE EXIT DEVICE WITH INFINITE DEADLOCKING**

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[21] Appl. No.: **726,121**

[22] Filed: **Oct. 4, 1996**

Related U.S. Application Data

[62] Division of Ser. No. 578,770, Dec. 26, 1995, Pat. No. 5,609,371.

[51] **Int. Cl.**^{6} **E05C 3/12**

[52] **U.S. Cl.** **292/219**; 292/92; 292/332

[58] **Field of Search** 292/219, 63, 65, 292/67, 68, 92, 146, 147, 163, 164, 169.13, 333–336, 220

[56] **References Cited**

U.S. PATENT DOCUMENTS

695,642	3/1902	Hearn	292/335
1,100,475	6/1914	Franckaerts	292/147
2,034,570	3/1936	Flavin	292/65
2,136,539	11/1938	Brinton	292/163
2,481,454	9/1949	Rousseau	292/146
3,029,096	4/1962	Welch	292/92
3,214,947	11/1965	Wikkerink	292/92
3,917,329	11/1975	Fujiki et al.	292/163
3,937,504	2/1976	McElroy	292/164
3,970,339	7/1976	Haselton et al.	292/227
4,005,886	2/1977	Lirette	292/177

FOREIGN PATENT DOCUMENTS

101999	9/1937	Australia	292/332

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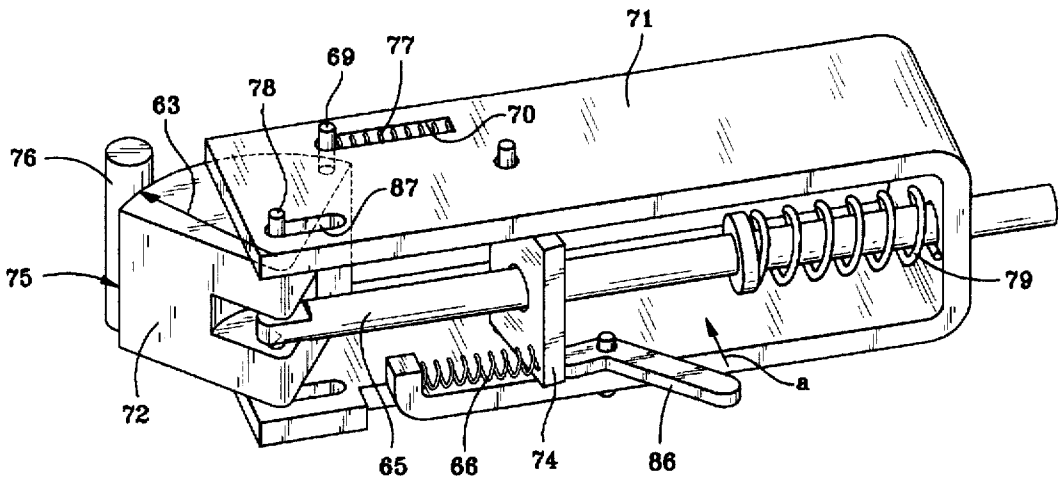
[57] **ABSTRACT**

A push pad releasable exit device with continuous deadlocking for mounting near a door edge for engaging a lock strike includes a housing having first and second sidewalls upon which are mounted two end walls and an internal wall parallel to the end walls, each of the end walls and the internal wall having a hole, the holes being aligned on a common axis, the first sidewall having a wedge stop projecting inwardly therefrom toward the axis of the holes in the end walls and the internal wall; a tapered latch bolt mounted on a cylindrical shaft, the shaft extending through the holes and having a provision for urging the latch bolt toward the lock strike; a wedge plate having a hole providing clearance around the shaft and aligned with the holes in the end walls, having a tab pivotally resting in a slot of the second wall, and having a corner distal from the tab resting against the wedge stop when the door is in an open position; a provision for sensing when the door is in a closed position and for flipping the wedge plate away from the wedge stop to grip the shaft and to thereby deadlock the latch bolt; and further provision for releasing the shaft in response to minimal deflection of the push pad to permit the latch bolt to ride over the lock strike driven only by the normal force required to open the door.

2 Claims, 5 Drawing Sheets



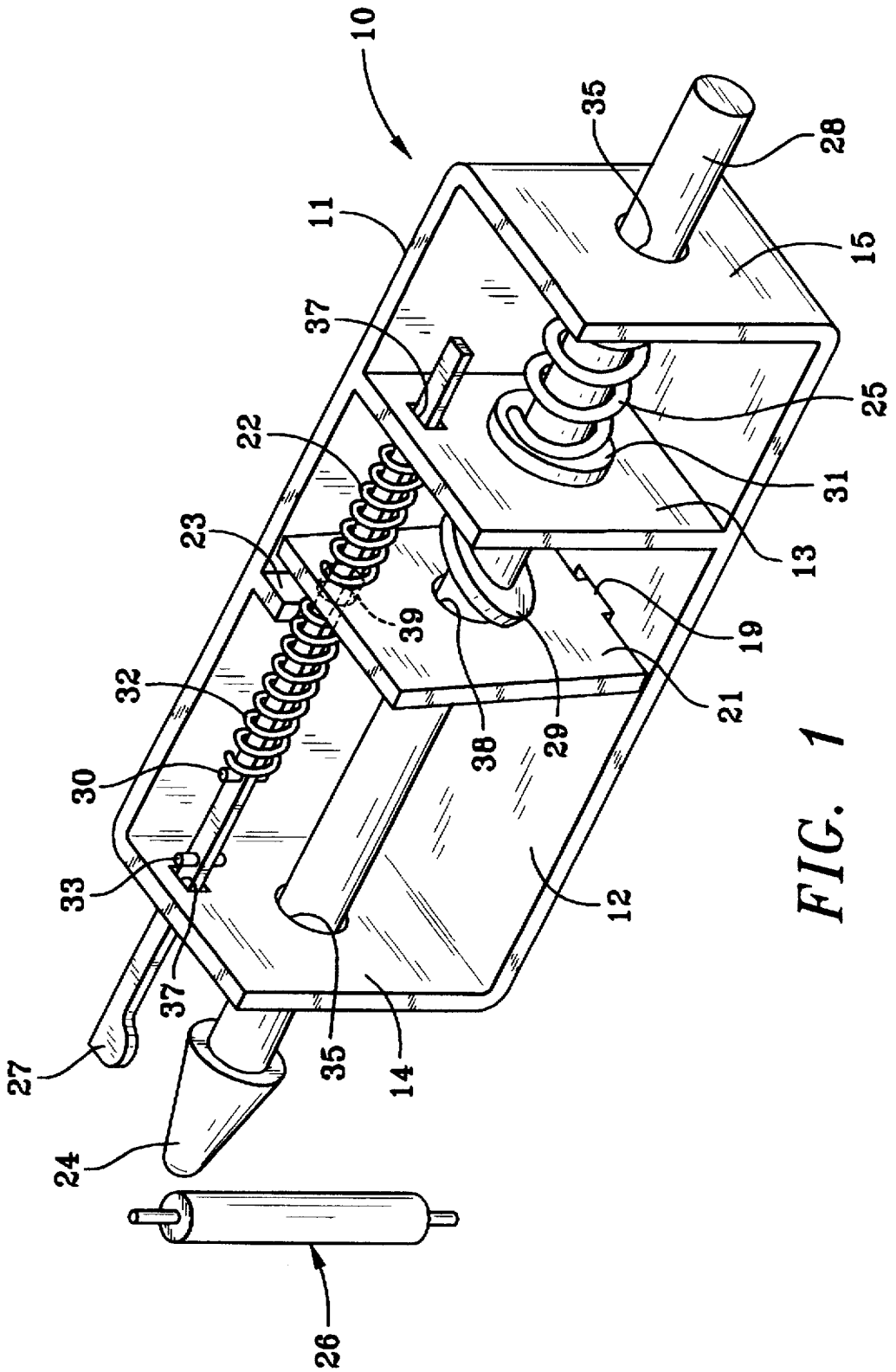

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FIG. 1

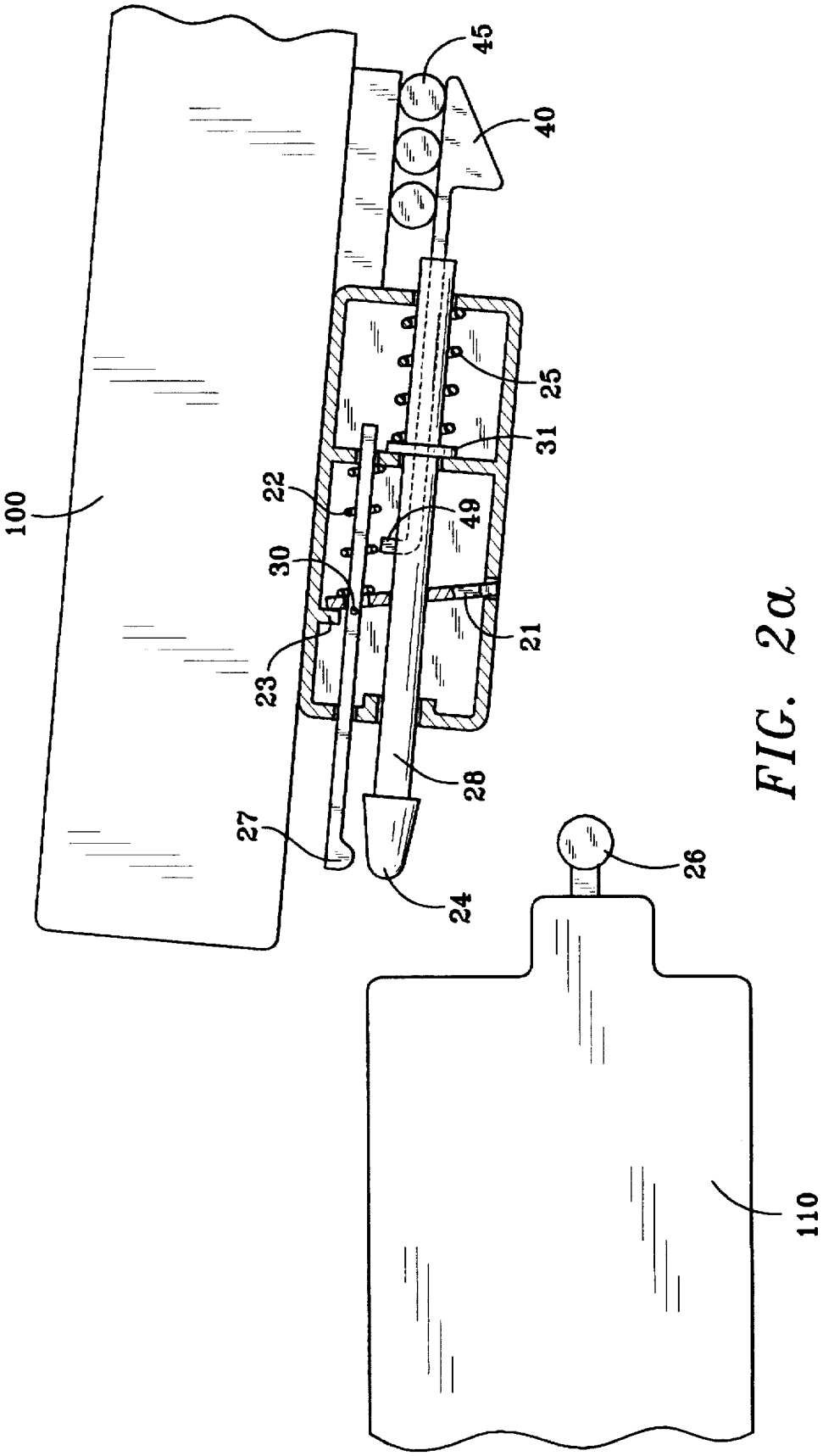

FIG. 2a

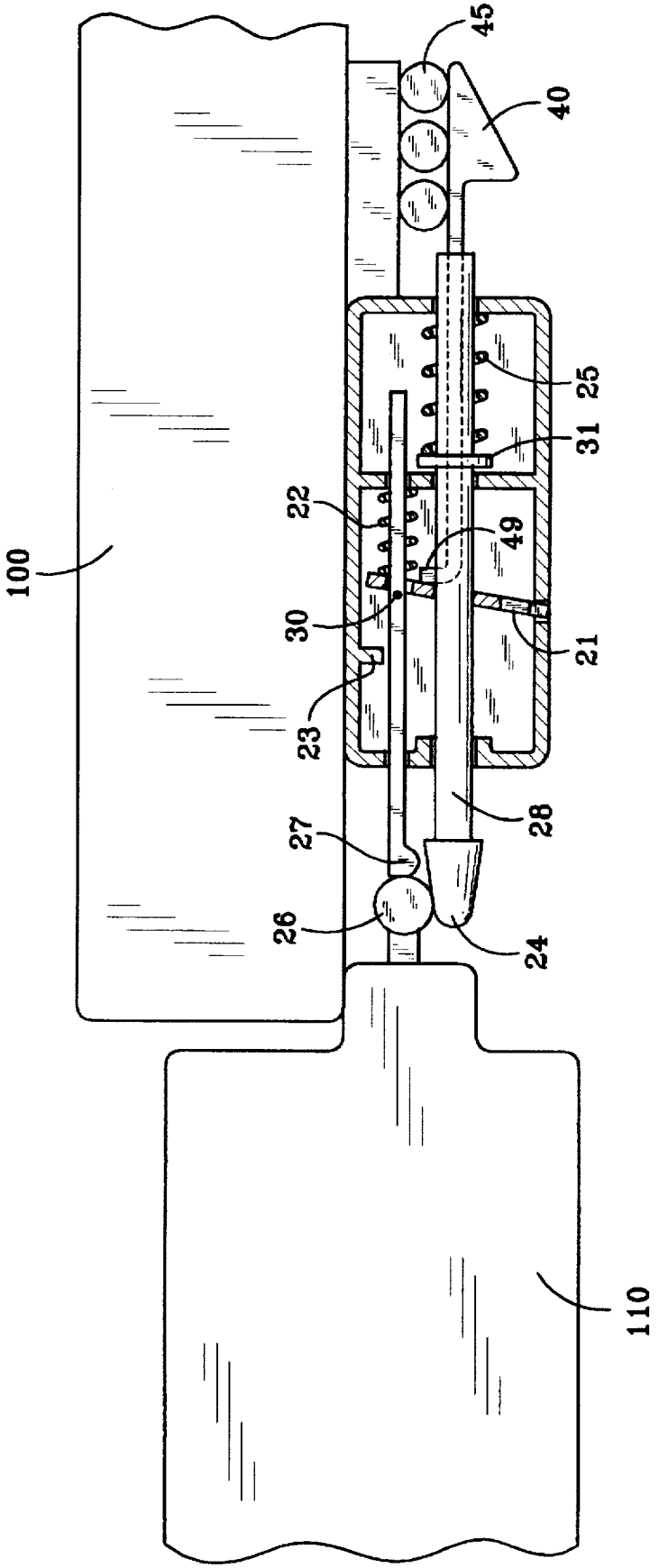

FIG. 2b

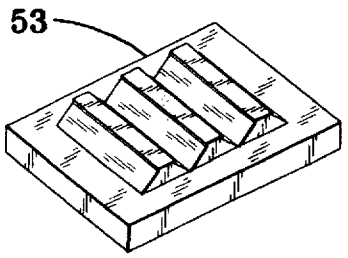

FIG. 3a

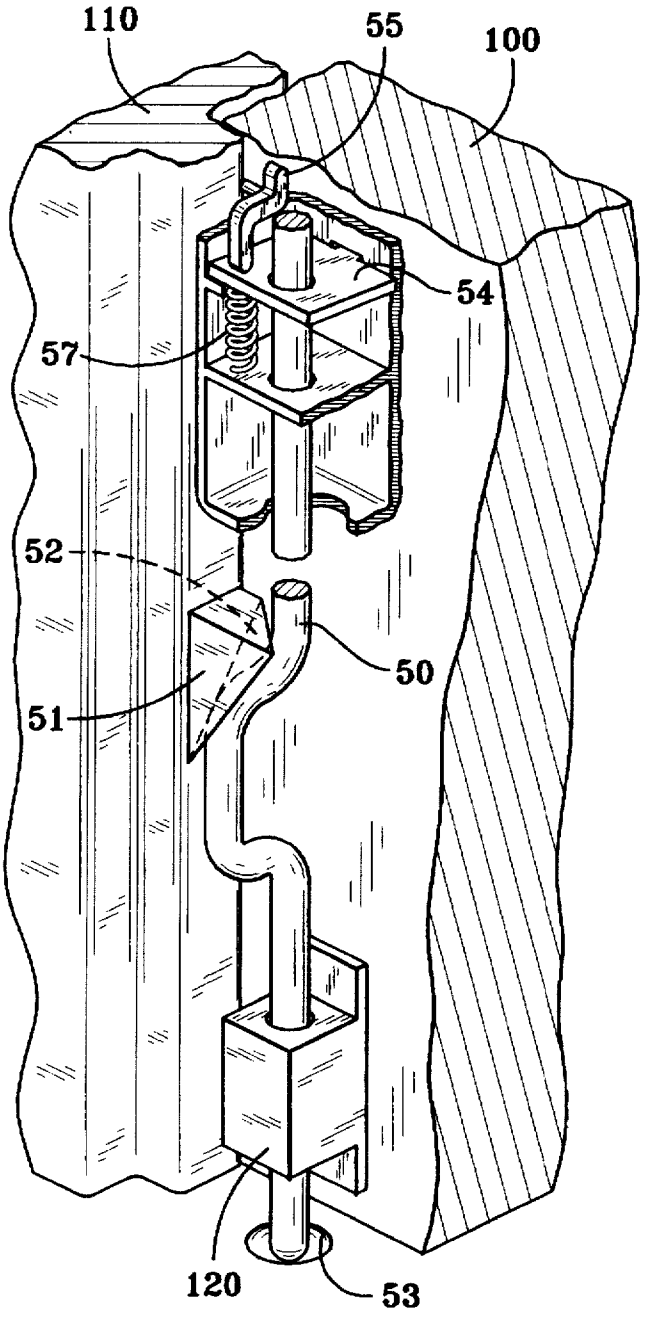

FIG. 3

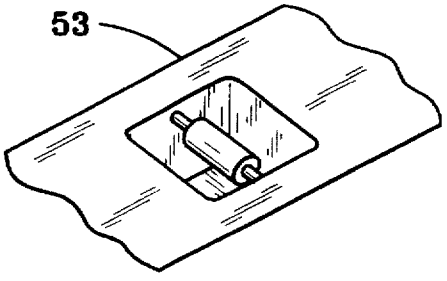

FIG. 3b

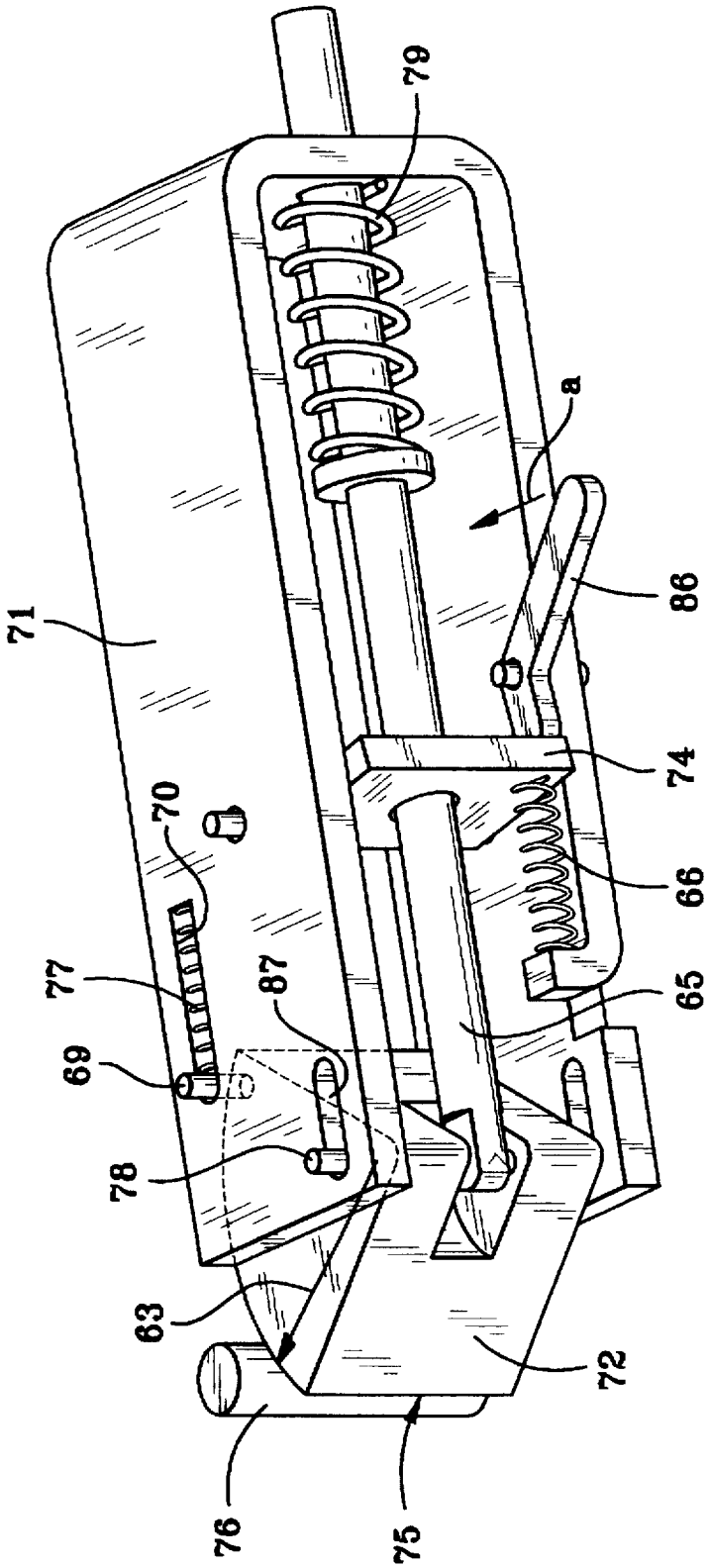

FIG. 4

PUSH PAD TRIGGER RELEASE EXIT DEVICE WITH INFINITE DEADLOCKING

This is a Division of application Ser. No. 08/578,770 filed Dec. 26, 1995 now U.S. Pat. No. 5,609,371.

BACKGROUND OF THE INVENTION

This invention relates generally to push pad operated exit devices and more particularly to exit devices having push pads requiring minimal motion for unlatching a door.

There are basically two types of push pad exit devices used to secure the entrance of a building, namely rim lock and vertical rod lock. The rim lock latches the door on the door edge opposite the hinge edge by means of a latch bolt which projects into a strike pocket located in the vertical door frame member. The vertical rod latches the door, on the same door edge as does the rim lock, with two latches, one projecting into a strike in the top horizontal portion of the door frame and the other projecting down into a floor mounted strike. The purpose of the rim lock and vertical rod lock is to secure an entrance, such that attempts to open the door from the inside of the building without pushing on the push pad or outside of the building using the door trim will fail.

In the rim latching application, the latch bolt is rotatable about a fixed axle. As the door is shut, the latch bolt rotates to bump over a fixed strike on the door frame. After clearing the strike, the latch bolt projects into the strike pocket. The latch bolt, being spring biased into the strike, locks the door to the frame.

Additional security and tamper resistance is provided by means of a deadlocking feature which, when activated, prevents the latch bolt from being retracted without the use of the push pad or trim. An auxiliary bolt, which is triggered by the closing of the door, enables the deadlocking feature when the auxiliary bolt is pressed into the door by the proximity of the door edge to the door strike. Deadlocking, which is maintained as long as the door remains closed, results from movement of a component within the push pad device which allows a blocking member to drop by gravity into a position to prevent the latch bolt from being externally manipulated or forced out of the strike to open the door. When the push pad is depressed, the auxiliary bolt is disengaged along with the deadlocking feature, and the latch bolt is physically retracted out of the strike pocket to open the door.

In vertical rod latching, a push pad on the inside of the door retracts the vertical latch bolts out of the strikes when pushed. The latches are normally spring biased into the strikes located in the floor and header of the frame. The vertical rod design requires some mechanism for keeping the latch bolts retracted inside the door once the door is open and the push pad is released since, while the push pad is depressed, both latch bolts are held in their retracted states. However, upon release of the push pad, the door begins to close, and the bottom latch drags on the floor. To prevent this drag, the top latch has a feature inside which keeps the latch bolts in the retracted position until the door closes. The top latch bolt is set in the retracted position by depressing the push pad, and the bottom latch bolt is physically connected to the top latch bolt by a series of linkages. The bottom latch bolt is held retracted by means of the linkages and the mechanism in the top latch responsible for setting the top latch bolt in the retracted position. A pin in the frame door stop depresses a trigger in the top latch as the door closes releasing the latch bolts into the strikes to lock the door.

Deadlocking, in the vertical rod applications, is accomplished by means of complicated timing of lever arms to block the latch bolts from external manipulation. These blocking mechanisms are, at best, capable of one to three latch bolt stopping positions. A latch in a vertical rod application incorporates a blocking member to prevent the latch bolt from being retracted by external means without the use of the push pad. When the door is closed, the extended position of the latch bolt allows a spring biased lever inside the latch to move into a position capable of blocking the latch bolt. This spring biased lever can have one to three steps which allow blocking of the latch bolt at three different extensions thereof. These different extensions of the latch bolt are required to account for the varied bottom door gaps encountered in the field. The push pad, when depressed, moves the blocking lever out of the path of the latch bolt to allow withdrawal of the latch bolt and opening of the door.

Both the rim latching and the vertical rod latching systems have disadvantages, namely, the gravity drop deadlocking design of the rim latching system is very sensitive to manufacturing tolerances and is prone to unreliability and field failures if not diligently monitored by the manufacturer. In the vertical rod system, the top latch is used to hold itself and the bottom latch retracted through a series of linkages and moveable components. As a result, any unavoidable play or clearances in the linkages accumulates in the bottom latch once the push pad is released, and the bottom latch will drag on the floor and must be adjusted independently by manipulation of the bottom rod. This is a serious drawback, in that field installation people usually do not have the expertise required to make these adjustments correctly. Since the deadlocking feature in the latches is dependent upon the air gap between the bottom of the door and the strike lip located in the floor, it becomes almost critical. The gap can vary between ¼" and ¾" and dictates different latch bolt extensions into the floor strikes. Since there are commonly only one to three deadlocking positions to allow adjustment for varying door bottom gaps and tolerance stack-up in the linkages, the quality of the deadlocking function is questionable.

The method of latch retraction is an objectionable feature which also relates to both rim lock and vertical rod lock systems. Latch retraction in both systems requires depression of the push pad by at least ¾ inches in order to provide sufficient motion in the retraction mechanism of the device to fully retract the latch bolt. When the push pad is not depressed, it projects outwardly from the door, interferes with passage of equipment through the doorway, and even lends itself to damage. In addition to its undesirable aesthetics, the large amount of motion for bolt retraction is accompanied by a proportionately large amount of noise and wear of the assembly.

The foregoing illustrates limitations known to exist in present push pad operated panic exit devices. Thus, it would be advantageous to provide an alternative directed to overcoming one or more of those limitations. Accordingly, a suitable alternative is provided including features more fully disclosed hereinafter.

SUMMARY OF THE INVENTION

In one aspect of the present invention, a push pad releasable exit device for mounting near a door edge for engaging a lock strike has a housing with first and second sidewalls and an end wall, the end wall having a circular hole, and the first side wall having a wedge spring seat projecting

inwardly therefrom; a rolling latch bolt extending longitudinally from between the sidewalls, having a substantially triangular cross section, one side of which describing approximately a 60° arc, in a plan view along the door edge, two pivot pins projecting through two corners of the bolt and biasedly journaled in slots in the sidewalls, one pivot pin providing pivotal mounting for the bolt on a cylindrical shaft, the shaft extending through the hole in the end plate and joining to the latch bolt pivot at the axis of the latch bolt radially inward from the contact point, on the arcuate surface of the latch bolt, with the lock strike; a wedge plate having a hole providing clearance around the shaft and aligned with the hole in the end wall, having an edge pivotally supported between the sidewalls, and having a corner distal from the pivotal support resting against the wedge spring; and means for releasing the shaft in response to minimal deflection of the push pad to permit the latch bolt to ride over the lock strike.

The foregoing and other aspects of the invention will become apparent from the following detailed description, when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWINGS

FIG. **1** is a perspective schematic view illustrating a rim latching embodiment of the push pad releasable exit device of the invention in the "door open" position;

FIGS. **2***a* and **2***b* show another embodiment of the rim latching exit device in "door open" and "door closed" positions, respectively;

FIGS. **3**, **3***a*, and **3***b* show a vertical rod locking embodiment of the invention and two additional floor strike options; and

FIG. **4** shows another embodiment of the invention for use with a rotating latch bolt in a rim latching application.

DETAILED DESCRIPTION

The invention employs a different operating principal from that described in the BACKGROUND OF THE INVENTION. Previous designs relied on a latch bolt that rotated to clear a fixed strike on closing, and required sufficient travel of the push pad to retract the bolt by means of a system of levers, axles, and rods. In the invention, a spring-loaded linear sliding latch bolt is profiled to "bump" over the door strike. Further, the push pad is not used to retract the latch bolt but to release a deadlocking mechanism which prevents opening of the door until the push pad is depressed. The motion of a person going through a door with the push pad depressed is sufficient to propel the latch bolt over the strike, thereby eliminating the need to have the push pad retract the bolt. This fact permits using the push pad only to trigger the disengagement of a pawl, a sear, or other escapement type of device. Such an arrangement requires only a bare minimum of motion of the push pad.

FIGS. **1**, **2***a*, and **2***b* show a rim lock embodiment of the invention with a few minor variations in the deadlocking release mechanism. The push pad trigger release exit device **10** consists of a housing which has a first sidewall **11**, a second sidewall **12**, two end walls **14**, **15**, an internal wall **13**, and a wedge stop **23** projecting inwardly from the first sidewall. The end walls **14**, **15** and the internal wall **13** have holes **35**, aligned on a common axis, in which a cylindrical shaft **28** is slidably disposed. Shaft **28** has a tapered latch bolt **24** on its outer end, a fixed angled swash plate **29** between end wall **14** and internal wall **13**, and a fixed spring rest **31** between internal wall **11** and end wall **15**. A wedge plate **21**, which has a tab **19** pivotally placed in a groove in the second sidewall **12**, is disposed between internal wall **13** and wedge stop **23** and also has a hole **38** providing a loose fit on shaft **28** and aligned on the common axis with holes **35**. There is also a hole **39** in a corner of wedge plate **21** nearest to wedge stop **23**. Hole **39** is aligned with other holes **37** in end wall **14** and internal wall **13**.

An auxiliary bolt **27** extends through holes **37** and **39** and has a slight clearance past the edge of wedge stop **23** limited by impingement of stop pin **33** against end wall **14** so the bolt **27** is free to reciprocate in the holes **37** and **39**. The auxiliary bolt **27** has a projection **30** which limits its reciprocation with respect to wedge plate **21**, thereby allowing wedge plate **21** to be flipped about tab **19** to deadlock shaft **28** and its attached tapered bolt **24** when the door is closed and auxiliary bolt **27** rests on roller strike **26**. Spring **22** is compressed by this motion of wedge plate **21** and stores the energy needed to release the shaft **28** from deadlocking when triggered by pressing on the push pad. This is best seen in FIGS. **2***a* and **2***b*, in which embodiments the first and second sidewalls are opposite each other in the housing rather than adjacent.

In operation, referring to FIGS. **1**, **2***a*, and **2***b*, the wedge **21** is biased by spring **22** so that it leans against wedge stop **23** when the door **100** is open. In this position, the hole **38** of the wedge has little, if any, contact with shaft **28**, and the shaft is biased to an extended position by spring **25** pushing between end wall **15** and spring rest **31**. As the door **100** is closed, the latch bolt **24** hits the roller strike **26** and, because of its tapered profile, bumps over the strike by momentarily compressing spring **25** and then returns to its extended position, latched against strike **26**.

When the door **100** is closed, the auxiliary bolt **27** is pushed in and rests against strike **26**. As the auxiliary bolt is pushed in, a projection **30** on bolt **27** engages spring **32** which pushes against wedge **21** and flips the wedge away from wedge stop **23** so that the edges of hole **38** engage shaft **28** and dead lock it in its extended position. Any attempt to push the latch bolt in without first depressing the push pad will cause the edges of hole **38** in wedge plate **21** to grip more tightly on shaft **28**. This feature can be considered infinite or continuous deadlocking; because the wedge **21** can grip shaft **28** at any position along its length, as long as the wedge **21** is flipped away from the wedge stop **23** by the auxiliary bolt **27** resting on strike **26**.

To open the door, it only requires a push against the push pad to trigger release the deadlock feature. In the embodiment of FIG. **1**, depression of the push pad causes rotation of shaft **28** by a few degrees. Swash plate **29** is fixed to shaft **28** at an angle substantially the same as that at which wedge plate **21** engages the shaft so that, the slightest rotation of the shaft causes the swash plates **29** to push against wedge **21** and releases the grip of wedge **21** on shaft **28** to allow the shaft to retract and bump over strike **26** as the door opens. Latch bolt **24** retraction is powered by the push force exerted on the push pad and transmitted to the door. This force is the amount normally required to open a door. Neither the push pad nor the mechanism for converting linear motion of the pad into rotary motion of the shaft are shown; because they are common combinations of levers, gears, rods, springs, wedges, and bearings which are found in innumerable devices and are well known in the art.

A linear-to-linear release is shown in FIG. **2***b* in which a push on the push pad causes a low friction push against an inclined face of a wedge shaped end of a release rod **40**

which rides on bearings **45**. Rod **40** moves leftward in the Fig. to force dog **49** against wedge **21** to release deadlocking of the shaft **28** and latch bolt **24**.

The vertical rod latching system shown in FIG. **3** can also benefit from use of the wedge plate design described. The door **100** is shown in the closed position against door frame **110** with its bottom rod **50** engaged with floor strike **53**. A downward facing deflector **51** is mounted on the door frame **110** in position to engage a corner of an offset portion of rod **50** as the door **100** closes. The sloping face **52** of deflector **51** forces rod **50** downward into engagement with strike **53**. Attempts to open the door **100** by pushing or pulling on the door without first depressing the push pad will fail. The bottom rod cannot move away from strike **53** because of the action of wedge plate **54**, and efforts to lift the rod only cause the wedge plate **54** to bite harder on the rod. When the push pad is pressed, pin **55** displaces wedge plate **54** to release the deadlocking of rod **50**. Note that spring **57** always biases wedge plate **54** upward so that it always is in position to grip rod **50** to prevent upward movement thereof. Pod **50** is also upwardly biased inside housing **120**. Except for direction, the top rod of a vertical rod latching system operates identically to the bottom rod described above. One major advantage of the continuous deadlocking of the present invention is that it permits such locking in a virtually infinite number of locations on the rod. This allows for firm locking in spite of changes in bottom door gap caused by settling or installation defects. It also allows use of the system with a variety of floor strike options, for example the hollow cylindrical strike pocket of FIG. **3**, the elevated toothed strike of FIG. **3***a*, and the recessed roller strike pocket of FIG. **3***b*.

A variation of the wedge plate concept is possible for use with a rotating latch bolt **75**. FIG. **4** shows such a rotating latch bolt. Starting from the open position, as the door closes, the latch bolt **75** is biased outwardly toward the strike **76** by compression springs **77** acting upon pin **69**. Latch bolt **75** can rotate about axle **78** and is stopped by pin **69** in the fully extended position by the termination of slot **70** in the housing **71**. As the door closes, the face **72** of the latch bolt **75** contacts the strike **76** and rotates clockwise into the housing **71** about axle **78** and compresses springs **77** in the process. Once the latch bolt clears the strike **76**, the compression springs **77** return the latch bolt **75** to its fully extended position as seen in FIG. **4**.

Deadlocking of the rotating latch bolt is accomplished without use of an auxiliary bolt. The radius **63** of the latch bolt **75** is such that its center coincides with the axle **78** and any force applied to open the door without releasing the wedge **74** will fail because of the alignment between the axle **78** and the strike **76** on the radius **63**. This eliminates any tendency for the latch bolt to rotate to accommodate the applied force. In order to open the door, the wedge **74**, which is forced against shaft **65** by spring **66**, must be displaced sufficiently leftward in the figure to release its grip on shaft **65**. This is done by trip lever **86** which abuts wedge plate **74** in its locking position and which also abuts the push pad before it is pressed. The shaft **65** is then free to move axially away from strike **76**. As shaft **65** moves through wedge **74** axle **78** is free to travel with the shaft **65** along slot **87** in the housing **71**. This allows the latch bolt **75** to pivot about pin **69** and to pass the strike **76** to allow opening the door. Once the latch bolt has cleared the strike **76**, compression spring **79** returns the shaft **65** and the axle **78** back to the position in which the latch bolt is fully extended. Spring **66** will return the wedge **74** to its locking position upon release of the push pad.

What is claimed is:

1. A push pad releasable exit device with continuous deadlocking for mounting near a door edge for engaging a lock strike, comprising:

a housing having first and second sidewalls, an open end, and an end wall opposite said open end, said end wall having a circular hole, and said first side wall having a wedge spring seat projecting inwardly therefrom;

a rolling latch bolt extending longitudinally from between said sidewalls, having a substantially triangular cross section, one side of which describing approximately a 60° arc, in a plan view across said open end, two pivot pins projecting through two corners of said bolt and biasedly journaled in slots in said sidewalls, one said pivot pin providing pivotal mounting for the bolt on a cylindrical shaft, said shaft extending through the hole in said end plate and joining to said latch bolt pivot at the axis of said latch bolt radially inward from a contact point with said latch strike on the arcuate surface of the latch bolt;

a wedge plate having a hole providing clearance around said shaft and aligned with the hole in said end wall, having an edge pivotally supported between said sidewalls, and having a corner distal from said pivotal support resting against said wedge spring; and

means for releasing said shaft in response to minimal deflection of said push pad to permit said latch bolt to ride over said lock strike.

2. The push pad releasable exit device of claim **1**, wherein the means for releasing said shaft in response to minimal deflection of said push pad to permit said latch bolt to ride over said lock strike comprises a trip lever for breaking the grip of said wedge on said shaft.

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